Great Lakes RESTORATION
2012
at the National Oceanic and Atmospheric Administration

The Great Lakes comprise the largest freshwater ecosystem on Earth. The restoration and protection of the Great Lakes is vital as they contain 95 percent of the surface freshwater in the United States and more coastline than the entire east coast. To contribute to the restoration of the Great Lakes, $300 million was invested in the region in 2012 by means of the Great Lakes Restoration Initiative (GLRI). As one of 15 Federal Agencies collaborating with U.S. EPA to implement this effort, the National Oceanic and Atmospheric Administration (NOAA) was allocated $14.5 million in 2012 to help accomplish restoration goals using its ground-breaking science, data products and services, predictive capabilities, and partnerships.

NOAA is making significant contributions to the restoration of the Great Lakes through the GLRI by expanding and enhancing many existing programs and implementing new innovative projects that address the GLRI Action Plan.

2012 Funded Projects

Toxic Substances & Areas of Concern
- Expanded Long-term Great Lakes Contaminant Monitoring
- Modeling Atmospheric Deposition to the Great Lakes
- Great Lakes Watershed Environmental Contamination Database Expansion
- Manistique AOC: Mussel Bioaccumulation Study
- Manistique AOC: Debris Removal FS and Design

Nearshore Health and Nonpoint Source Pollution
- Decision Support Tool for Nearshore Water Quality Prediction*
- Identifying Land Use Indicators and Tipping Points that Threaten Great Lakes Ecosystems*
- LaMPs and Land Cover Assessment

Aquatic Invasive Species
- Regional Ecosystem Prediction - Aquatic Invasive Species in the Great Lakes
- Sea Grant Outreach and Education

Habitat and Wildlife Protection and Restoration
- Coastal and Estuarine Land Conservation Grant Program
- Area of Concern Land Acquisition
- Area of Concern Project Design and Implementation
- Habitat Restoration Partnerships

Accountability, Education, Monitoring, Evaluation, Communication, and Partnership
- Great Lakes Observing System Implementation and Enhancement*
- Coordination and Prioritization of Great Lakes Climate Change Activities
- Establishment of a Bay Watershed Education and Training (B-WET) Program in the Great Lakes
- Assessment of Lake Ontario Benthic Macroinvertebrates*

*GLERL Project
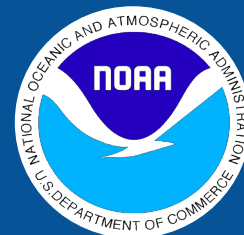
"We must leave the Great Lakes better for the next generation than the condition in which we inherited them"

- Great Lakes Restoration Initiative Action Plan

As a hub for regional science expertise, scientific products, and coordination, the Great Lakes Environmental Research Laboratory (GLERL), led by Dr. Marie Colton, is directing NOAA's implementation of the Great Lakes Restoration Initiative. In addition to administration of the effort, GLERL is conducting the following scientific research projects:

Nearshore Health and Nonpoint Source Pollution

Improve Coastal Human Health and Develop Beach Forecasting Models

Implement techniques for predicting water quality at beaches up to two days in advance, and forecasting the trajectory and fate of harmful algal blooms in the Great Lakes. Improve models by using remote sensing, in-lake monitoring, and confirmation of blooms, and transition these improved hydrodynamic models to an operational status.

Identify Land Use Tipping Points that Threaten Great Lakes Ecosystems and Land Use Change and Agricultural Lands Indicator Development

Create science-based measures to assess the state of the Great Lakes ecosystem and identify tipping points in Great Lakes nearshore areas. The indicators will be used at the *State of the Lake Ecosystem Conference*, as a science-based mechanism to strengthen decision making and management in developing policies, ordnances, and land protection programs, and identify restoration priorities needed to sustain Great Lakes ecosystems.

Invasive Species

Great Lakes Aquatic Nuisance Species Information System (GLANSIS) Database

Expansion of the database will enhance and improve information on aquatic invaders in the Great Lakes available through GLANSIS online (*www.glerl.noaa.gov/res/Programs/glansis/glansis. html*). Improvements will include the addition of range-expansion species and high-risk potential invaders that have been identified in the scientific literature and also the addition of new, simplified fact sheets. These enhancements will also improve consistency within the database with respect to the way that the impacts of each invader are described.

Accountability, Education, Monitoring, Evaluation, Communication, & Partnership

The Great Lakes Observing System Implementation and Enhancement

Provide a comprehensive near-term design for a coastal observing system that will provide data on the physical, chemical, and biological parameters necessary for the effective management of nearshore aquatic resources to support remediation, restoration, and conservation actions.
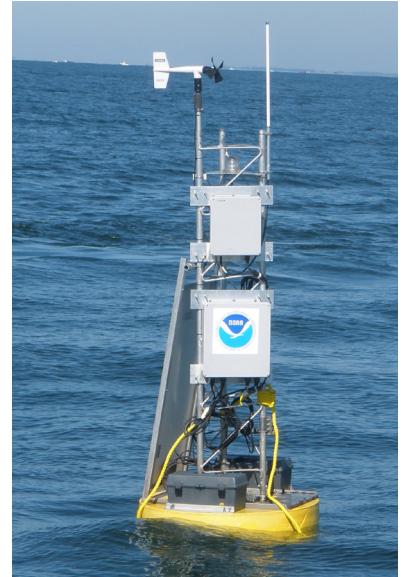
Regional Climate Research for Application to Decision Making

To determine the best course of action for decision-makers, several models have stood out in the Great Lakes region for creating a downscaled climate model. These methods include climate parameters that are unique to the Great Lakes and are important to provide answers and form conclusions about future climate scenarios. NOAA will provide the single authoritative prediction of future climate in the region to direct the focus of restoration efforts.

For more information, visit www.glerl.noaa.gov

Toxic Substances and Areas of Concern

funded by the Great Lakes Restoration Initiative

NOAA is working to confront toxics in the Great Lakes. While concentrations of some persistent toxic substances have been significantly reduced in the Great Lakes over the past 30 years, toxins such as polychlorinated biphenyls (PCBs) are still presently above levels considered safe for humans and wildlife, warranting fish consumption advisories in all five Great Lakes. In addition, chemicals of emerging concern, such as pharmaceuticals, are now being detected in the Great Lakes. NOAA is evaluating hazards from toxic substances so that regulatory and management responses can protect human and ecosystem health.

Expanded Long-term Contaminant Modeling

NOAA's well-established Mussel Watch Program monitors the status and trends of chemical contamination and associated effects in US coastal waters, including the Great Lakes. Mussel Watch involves the annual collection and analysis of mussels, which filter Great Lakes water, to provide an indication of local contamination levels. GLRI funds have expanded monitoring in the Great Lakes to determine impacts of contaminant releases and to screen for contaminants of emerging concern.

Modeling Atmospheric Mercury Deposition

Regional and global sources continue to deposit mercury to the Great Lakes via the air. Mercury can affect the human nervous system, fish, and wildlife. The most common way that people are exposed to mercury is by eating contaminated fish or shellfish. NOAA is using model output to determine the amount, source, and types of atmospheric mercury deposited in the Great Lakes. Project results will be used to develop an action plan to reduce mercury in the Great Lakes.
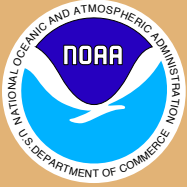
Great Lakes Environmental Contamination Database

Making good decisions to improve the environment and human health requires high quality data. This project is compiling sediment and wildlife contamination data from a variety of sources to improve NOAA's Query Manager database. This data is being analyzed and used to inform and expedite decision-making related to cleanup and restoration. NOAA is coordinating with and providing financial support to state partners in t his effort.

Lake Sturgeon Health Assessment

PCBs and dioxins have been linked to cancer and other serious health effects in animals and humans. Lake sturgeon were historically one of the most important fish in the Great Lakes. Today, they are listed by the state of Michigan as threatened, in part because PCB contamination affects their ability to reproduce. This project is working to determine the PCB threshold level that could affect early life stage survival. Results will be applied to the assessment, cleanup, and restoration of contaminated sites to improve habitat quality and fisheries in Areas of Concern and throughout the basin.

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Great Lakes
RESTORATION

Aquatic Invasive Species

funded by the Great Lakes Restoration Initiative

Progress toward restoring the Great Lakes has been significantly undermined by the effects of non-native aquatic, wetland, and terrestrial invasive species. More than 180 nonindigenous aquatic species (NAS) now exist in the Great Lakes. The most invasive of these - including the well known zebra mussel - reproduce and spread, ultimately degrading habitat, out-competing native species, and short-circuiting food webs. Without forecasting the arrival and bioeconomic impact of nonindigenous species, natural resource managers cannot cost effectively respond to current invasions or prevent future invasions.

NOAA's Aquatic Invasive Species efforts under the GLRI provide a foundation towards meeting the GLRI goal of developing "A comprehensive program for detection and tracking newly identified invasive species in the Great Lakes and providing up-to-date critical information needed by decision makers for evaluating potential rapid response actions."

Forecasting Risk

With GLRI funding, NOAA-supported investigators at the University of Notre Dame are combining scientific, economic, risk analysis, and management expertise to increase capabilities for forecasting both the ecological and economic impact of current and future species invasions, quantify major uncertainties and ways to reduce uncertainty, and identify actions to improve cost effective management of invasive species in the Great Lakes.

Improving Information Access: GLANSIS

The Great Lakes Aquatic Non-Indigenous Species Information System (GLANSIS) functions as a Great Lakes specific node of the USGS Nonindigenous Aquatic Species national database. GLANSIS provides targeted access to the information – especially collection records – for the Great Lakes region. In creating GLANSIS, NOAA has committed to providing a 'one-stop-shop' for technical information on all nonindigenous species established in the Great Lakes, including maps of the current distributions. GLANSIS currently includes profiles for 184 nonindigenous species that have become established in the Great Lakes. With GLRI funding, GLANSIS is expanding its information resources to better serve the needs of natural resource managers. The expanded GLANSIS includes profiles for range expansion species (native to one part of the basin, but invading other parts) and those forecasted at the highest risk for invasion, as well as risk assessment information and public fact sheets supporting citizen monitoring.

Asian Carp Education and Outreach

This project is using the established outreach and extension programs of the eight Great Lakes Sea Grant programs to respond to opportunities and requests for education and outreach on regional control efforts for Asian carp.

Great Lakes RESTORATION

Nearshore and Non-Point Source Pollution
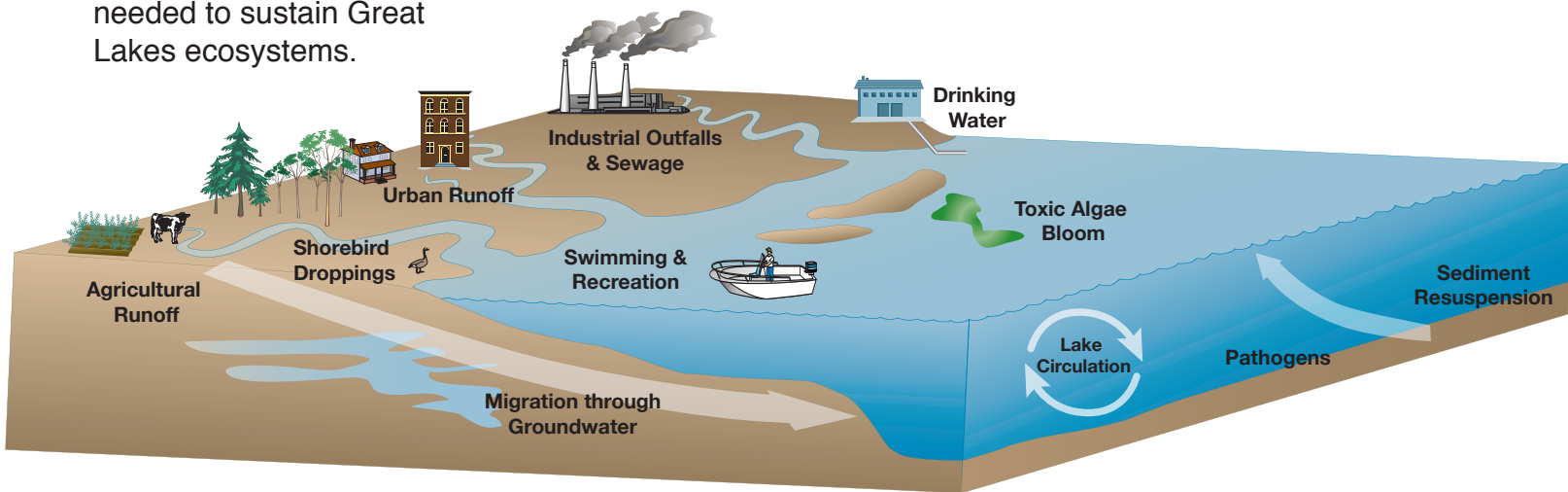*funded by the Great Lakes Restoration Initiative*

To address President Obama's call to action to restore the Great Lakes, NOAA has funded projects within the Nearshore Health and Nonpoint Source Pollution priority area of the Great Lakes Restoration Initiative (GLRI). The GLRI Action Plan calls for action to identify sources and reduce loadings of nutrients and soil erosion as well as improve public health protection at beaches. NOAA's projects listed below support efforts to improve nearshore areas and reduce nonpoint source pollution in the waters of the Great Lakes.

Identifying Land Use Indicators and Tipping Points

Communities need to know at what point the ecosystem will take a turn for the worse. A group of collaborative researchers and planners are working to find this "tipping point" and inform communities of what they can do to stay below it. This will be accomplished through the development of a statistical model based on land-use data to identify land-use change impacts on aquatic natural resources. Scientists will compare models to find the linkages between land use at township/county levels and impacts on the Great Lakes. This project is identifying land-use indicators and tipping points in Great Lakes nearshore areas that can be used to develop policies, ordinances, and land protection programs, and identify restoration priorities needed to sustain Great Lakes ecosystems.

Improving Coastal and Human Health and Beach Forecasting
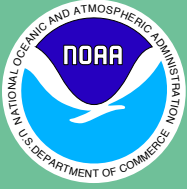
Current water quality monitoring involves a lag time between sample collection and water quality reporting. This may permit swimming at coastal beaches when bacterial levels could pose health threats or unregulated toxic algal blooms could occur. The purpose of this work is to develop and implement techniques for predicting water quality at beaches up to 2 days in advance and for forecasting the movement and fate of harmful algal blooms in the Great Lakes. Predictive models enable environmental and public health officials to notify the public of expected water quality 1-2 days in advance, thereby preventing beach closures when conditions are safe and avoiding negative local economic impacts.

Industrial Outfalls & Sewage

Drinking Water

Urban Runoff

Shorebird Droppings

Swimming & Recreation

Toxic Algae Bloom

Sediment Resuspension

Agricultural Runoff

Lake Circulation

Pathogens

Migration through Groundwater

Great Lakes RESTORATION

Habitat and Wildlife Protection and Restoration

funded by the Great Lakes Restoration Initiative

The health of Great Lakes habitats and wildlife depends upon the protection and restoration of ecosystems. A multitude of threats affect the health of Great Lakes habitats and wildlife, and many opportunities exist to protect and restore critical elements of the Great Lakes ecosystem.

NOAA Restoration Center

NOAA Restoration Center in the Great Lakes provides financial and technical assistance to remove dams and barriers, construct fish passage, clean up marine debris, restore coastal wetlands, and remove invasive species in Great Lakes Areas of Concern. In addition, NOAA's Restoration Center also supports partnerships that allow for a targeted approach to address priority projects in Great Lakes Areas of Concern including design and engineering of habitat restoration projects, on-the-ground restoration work, project evaluation to inform future restoration efforts, and climate change expertise to inform restoration planning and implementation.

Black River, Lorain, OH. Four GLRI-funded projects in the Black River Area of Concern include the construction of 5000+ linear ft. of fish habitat shelves, approx. 1500 ft. of riverbank stabilization and restoration, the removal of 45,000 cubic yards of steel slag, the restoration of 2.3 acres of riparian habitat, the engineering and design of additional in-stream and bank restoration, and the treatment of invasive species.

Coastal and Estuarine Land Conservation Program

The Coastal and Estuarine Land Conservation Program (CELCP) provides state and local governments with matching funds to purchase significant coastal lands. GLRI Land Acquisition CELCP projects will protect wetlands and other important coastal habitats, reduce coastal water pollution, and provide the public with access to Great Lakes coasts.

Mashek Creek Property Protection. NOAA and the Wisconsin Coastal Management Program are working together to support the permanent protection of the 26.87 acre Mashek Creek property, which includes 1,700 feet of Lake Michigan shoreline. Wooded areas on this parcel provide important stopover habitat for migrating neotropical migrants and raptors moving along the shores of Lake Michigan. The Wisconsin Dept. of Natural Resources matched federal funds awarded through the CELCP.

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Accountability, Education, Monitoring, Evaluation, Communication, and Partnerships *funded by the Great Lakes Restoration Initiative*

The Great Lakes Restoration Initiative Action Plan requires oversight, monitoring, assessment, and coordination to succeed. NOAA is contributing to these needs by providing a coordinated network of scientific observations, information for decision makers about the impacts of climate change, and the implementation of adaptive management through the Lakewide Management Plan (LaMP) process. These projects are helping provide the scientific data, education, and collaboration necessary to sustain this investment in Great Lakes restoration.
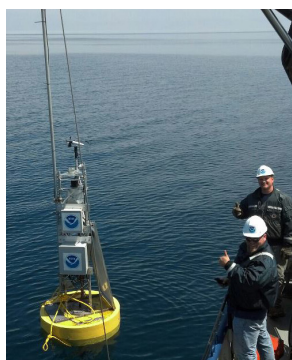
Implementing a Great Lakes Observing and Response System

This project is focusing on the design and implementation of the Great Lakes Observation and Response System to coordinate and integrate regional coastal observations supporting national and regional priorities including Great Lakes restoration. GLRI funds are being used to support a federal data management and communications system, modeling and decision support tools, and on-water observation system components focused on Areas of Concern and restoration projects.

Coordinating Implementation of Lakewide Management Plans

The GLRI is providing support for an enhanced process of developing and implementing Lakewide Management Plans for each of the five Great Lakes. As part of this effort, NOAA is using the Coastal Change Analysis Program (C-CAP) for updates on Lakes Erie and Ontario.

Establishing a Great Lakes Bay Watershed Education and Training (B-WET) Program

B-WET is a NOAA environmental education program for K-12 students. It offers competitive grants to support existing education programs, foster the growth of new programs, and encourage development of program partnerships.

Enhancing Climate Change Information and Creating Resilient Communities

The goal of addressing climate adaptation and mitigation is important to NOAA, and NOAA is working to create an informed society that is anticipating and able to respond to climate change and its impacts. NOAA's efforts in the Great Lakes focus on the collection of baseline climate data, increasing the understanding of climate change impacts, and customizing adaptation strategies within Great Lakes communities to enable informed decisions throughout the basin.

This includes:

- Extending existing regional climate models, creating a larger set of possible climatic outcomes, and broadening current models to include 3-D visualization and ice cover.

- Working with regional and state partner organizations to develop and implement a community-focused approach to assessing and managing the impacts of climate change.

- Producing an online lake level viewer that will accomodate higher lake level and lower lake level scenarios, enabling stakeholder groups to visualize potential impacts of such changes in lake levels.

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